

II. REMARKS

Claims 2, 21 and 22 have been cancelled without prejudice, claims 1, 11, 13, 16 and 20 have been amended, and new claims 23-26 have been added. Specifically, independent claims 1 and 20 have been amended to incorporate subject matter from original claim 2, and to recite “wherein component (A) contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component” as supported by ¶¶ [0026], [0027], [0028], [0029] and [0087], of Applicants’ specification as originally filed.

Claims 11, 13 and 16 have been amended to depend upon claim 20.

New claim 23 depends upon claim 1, and additionally recites “wherein the component (C) contains 1.0 to 2.0 parts by weight of 2,4,5-triarylimidazole dimer, with respect to 100 parts by weight as the total of component (A) and component (B)” as supported by Table 2 and in ¶ [0092], which describes photosensitive resin compositions according to Examples 1 to 5, which contain, for example, 1.0 to 2.0 parts by weight of 2,2’-bis (o-chlorophenyl)-4,4’,5,5’-tetraphenylimidazole dimer, with respect to 100 parts by weight as the total of component (A) and component (B).

New claim 24 depends upon claim 1, and additionally recites “wherein the component (A) contains 0.1 to 30 wt% of the styrene or styrene derivative as a copolymerizing component, with respect to the total amount of component (A)” as supported by ¶ [0027], which describes that styrene or styrene derivative content is preferably 0.1-30 wt% in order to achieve satisfactory adhesion and release properties.

New claim 25 depends upon claim 6, and pertains to a resist pattern forming method comprising steps of “laminating,” “irradiating” and “removing” as supported by ¶¶ [0071] to [0077] of Applicants’ specification as originally filed. In particular, Applicant’s specification, at ¶¶ [0076] to [0077], describe that an aqueous alkali solution for wet

development may be, for example, a 0.1-5 wt% sodium carbonate dilute solution, a 0.1-5 wt% potassium carbonate dilute solution, or a 0.1-5 wt% sodium hydroxide dilute solution.

New claim 26 depends upon claim 25, and pertains to a process for manufacturing a printed circuit board as supported by ¶¶ [0078] to [0081] of Applicants' specification as originally filed.

The present amendment adds no new matter to the above-captioned application.

A. The Invention

The present invention pertains broadly to a photosensitive resin composition, such as may be used to manufacture a photosensitive element, and/or may be used to manufacture a printed circuit board. In accordance with an embodiment of the present invention, a photosensitive resin composition including the features recited by independent claim 1 is provided. More specifically, the invention according to independent claim 1 relates to photosensitive resin composition comprising: (A) a binder polymer having an acid value of 45-200; (B) a photopolymerizing compound with an ethylenic unsaturated bond; (C) a photopolymerization initiator; and (D) a compound represented by the following general formula (1a), (1b), (1c), or (2). Component (A) contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component, component (B) contains a bisphenol A-type (meth)acrylate compound, and component (C) contains a 2,4,5-triarylimidazole dimer" according to the embodiment of the invention recited by claim 1.

In accordance with another embodiment of the present invention, a photosensitive resin composition including the features recited by independent claim 20 is provided. Various other embodiments, in accordance with the present invention, are recited by the dependent claims.

An advantage provided by the various embodiments of the present invention is that a photosensitive resin composition is provided that unexpectedly exhibits improved adhesion and photosensitivity characteristics.

Conventionally, a photosensitive resin composition may obtain improved photosensitivity by means of a photosensitive initiator, such as 2,4,5-triphenylimidazole dimer; however, it cannot obtain desirable properties pertaining to a less contaminating plating solution, resolution and adhesion properties (See, e.g., ¶ [0007] of Applicants' specification). Generally, as would be known by a person of ordinary skill in the art, raising the photosensitivity can harden the unexposed parts of the photosensitive resin composition layer and, as a result, tends to make resolution low. Furthermore, strengthening adhesion to the substrate tends to also make resolution low. Thus, as would be known by a person of ordinary skill in the art, adhesion and resolution characteristics are in a trade-off relationship (i.e., as one improves, the other deteriorates). Consequently, as would be known by a person of ordinary skill in the art, it has been difficult to simultaneously improve and/or balance photosensitivity, resolution, and adhesion characteristics. In addition, the addition of photopolymerization initiator, which has poor solubility to organic solvents such as 2,4,5-triarylimidazole dimer in relatively large amounts, can cause a problem with respect to sludge generated in the developer (See, e.g., ¶ [0007] of Applicants' specification).

By having components (A) to (D), a photosensitive resin composition, in accordance with the presently claimed invention, maintains high photosensitivity properties while maintaining sufficiently high resolution and adhesion properties and while suppressing contamination of the plating solution and the generation of sludge in the developing process. Sludge in the developing process refers to oily sludge that is generated without dispersing or dissolving in the developing process. Such generated sludge adheres on the substrate and may cause a short circuit and disconnection in the circuit pattern after etching or plating

treatment. Furthermore, the sludge can adhere to the developer tank and contaminate it. Therefore, it is desirable to sufficiently suppress the generation of sludge as is achieved by the present invention.

B. The Rejections

Claims 21 and 22 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement.

Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Ohta et al. (U.S. 5,476,690, hereafter the “Ohta Patent”) in view of Grubb et al. (U.S. 3,647,467, hereafter, the “Grubb Patent”). Claims 1-6 and 10-20 also stand rejected under 35 U.S.C. § 103(a) as unpatentable over Amanokura et al. (U.S. 6,060,215, hereafter the “Amanokura Patent”) in view of the Grubb Patent.

In view of the present amendment, Applicants respectfully traverse the present rejections and request reconsideration and allowance of the claims for the following reasons.

C. Applicants’ Arguments

In view of the present amendment, remaining claims 1, 4-8, 11, 13, 15, 16, 18-20 and 23-26 are in compliance with 35 U.S.C. § 112.

i. The Section 103 Rejections

A prima facie case of obviousness requires a showing that the scope and content of the prior art teaches each and every element of the claimed invention, and that the prior art provides some teaching, suggestion or motivation, or other legitimate reason, for combining the references in the manner claimed. KSR International Co. v. Teleflex Inc., 127 S.Ct. 1727, 1739-41 (2007); In re Oetiker, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992). Furthermore, a proper

rejection under Section 103 requires showing that when a person of ordinary skill in the art would have had a legitimate reason to attempt to make the composition or device, or to carry out the claimed process, that the person of ordinary skill in the art would also have had a reasonable expectation of success in doing so. PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007).

In this case, the Examiner has failed to establish a prima facie case of obviousness against independent claims 1 and 20 because (i) the combination of the Ohta Patent, the Amanokura Patent and the Grubb Patent does not teach, or suggest, “component (A) contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component” as recited by claims 1 and 20 of the present application, (ii) the Examiner has failed to establish a legitimate reason to justify the combination of the Ohta Patent with the Grubb Patent, and (iii) because the Examiner has failed to establish that a person of ordinary skill in the art would have had a reasonable expectation of success of arriving at Applicants’ claimed invention if the combination of Ohta, Amanokura and Grubb were made.

ii. The Ohta Patent

The Ohta Patent discloses a “process for preparing printed circuit board” that includes the steps of: (1) forming, on the surface of an insulating substrate on a necessitate portion of which electrolessly plated copper is to be precipitated, a layer of a light-sensitive resin composition comprising (a) 40 to 80 parts by weight of a vinyl-polymerized high molecular weight binder having an acid value of 10 to 46 mgKOH/g, (b) 20 to 60 parts by weight of a compound having at least two polymerizable unsaturated double bonds in a molecule, with the total amount of Components (a) and (b) being 100 parts by weight, and (c) a photopolymerization initiator generating free radicals by irradiation of active light in an

amount of 0.1 to 10 parts by weight based on 100 parts by weight of Components (a) and (b); (2) forming a negative pattern of the light-sensitive resin composition on the surface of the substrate by irradiating active light imagewise and developing with a semi-aqueous developing solution; and (3) forming a circuit pattern by electroless copper plating by using the negative pattern of the light-sensitive resin composition on the surface of the substrate as a plating resist (See Abstract of the Ohta Patent). The Ohta Patent discloses that the binder polymer having an acid value of 10 to 46 mgKOH/g is a high molecular weight binder, that the compound having at least two polymerizable unsaturated double bonds in a molecule may be bisphenol A, and that the photopolymerization initiator may be 2,4,5-triarylimidazole dimer (Ohta Patent, col. 4, lines 5-10; col. 5, lines 55-59; and col. 6, lines 13-33). As examples of vinyl monomer used for vinyl-polymerized type high molecular weight binder, the Ohta Patent discloses (meth)acrylic acid alkyl esters such as acrylic acid, methacrylic acid, and methyl methacrylate, styrene, and styrene derivatives such as α -methylstyrene (Ohta Patent, col. 4, lines 5-13). In Synthetic Examples 1-5, the Ohta Patent further discloses a high molecular weight binder that uses methacryl acid, methyl methacrylate and butyl methacrylate as copolymerizing components (Ohta Patent, col. 8, line 65, to col. 10, line 46).

As admitted by the Examiner (Office Action, dated June 10, 2008, at 4, lines 3-4), the Ohta Patent does not teach, or even suggest, component (D) recited by independent claims 1 and 20, namely, “a compound represented by the following general formula (1a), (1b), (1c), or (2)” as recited by independent claim 1, and “one or more compounds selected from the group...” recited by independent claim 20. However, this is not the only deficiency in the disclosure of the Ohta Patent.

The Ohta Patent also does not specifically disclose selectively using styrene or a styrene derivative as a copolymerizing component, or employing a binder polymer that contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters and

styrene or a styrene derivative as copolymerizing components. Therefore, the Ohta Patent does not teach, or suggest, “component (A) contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component” as recited by independent claims 1 and 20.

Furthermore, the Ohta Patent does not teach, or suggest, adjusting the acid value of the binder polymer to “45-200 mg KOH/g” as recited by claims 1 and 20. Although the Ohta Patent discloses Comparative Synthetic Examples 1 and 2, wherein the binder polymers have acid values of 52 mgKOH/g and 78.2 mgKOH/g, respectively (Ohta Patent, col. 11, lines 1-35), the Ohta Patent also discloses in the Examples at col. 8, line 59, to col. 10, line 46, binder polymers having acid values ranging from 19.6 mgKOH/g to 39.1 mgKOH/g. The Ohta Patent also explicitly states that

the copolymerization rate of the vinyl monomer having an acidic polar group such as acrylic acid, methacrylic acid and p-vinylbenzoic acid is limited to such a rate that the acid value of the vinyl-polymerized type high molecular weight binder (a) obtained by copolymerization is in the range of 10 to 46 mgKOH/g. If the acid value of the vinyl-polymerized type high molecular weight binder (a) is less than 10 mgKOH/g, developability with a semi-aqueous developing solution is lowered, while if it exceeds 46 mgKOH/g, a gap is generated between a resist and plated copper to lower resistance to electroless copper plating property. In order to obtain better developability and highly reliable resistance to electroless copper plating property, the acid value of the vinyl-polymerized type high molecular weight binder (a) is preferably in the range of 20 to 40 mgKOH/g.

(Ohta Patent, col. 5, lines 8-22, emphasis added).

Thus, the Ohta Patent explicitly teaches away from acid values exceeding 46 mgKOH/g due to the fact that such higher acid values will result in an undesirable gap between the resist and the plated copper so as to lower resistance to the electroless copper plating property. The Ohta Patent pertains to a process for preparing a printed circuit board wherein excellent resistance to electroless copper plating is achieved and contamination of the plating solution is diminished by keeping the acid value of the binder polymer in the

range of 10 to 46 mgKOH/g (Ohta Patent, col. 1, line 66, to col. 2, line 13; and col. 5, lines 8-22). Therefore, the subject matter disclosed by Ohta pertains to a completely different technical innovation than that of the present invention, and even teaches away from the limitation wherein “the acid value of component (A) is 45-200 mg KOH/g” as recited by claims 1 and 20 of the present invention.

In sum, the subject matter disclosed by the Ohta Patent pertains to development of a light-sensitive resin composition with subaquatic developer and aims to improve electroless copper plating resistance, and the property of decreasing contamination of a plating solution, by adjusting the acid value of the binder polymer to be in the range of 10 to 46 mgKOH/g. The presently claimed invention, on the other hand, suppresses contamination of a plating solution and the generation of sludge, and further improves photosensitivity, resolution and adhesion by employing the combination of components (A) to (D) as claimed. The Ohta Patent does not teach, or suggest, that its light-sensitive resin composition can suppress sludge generation, achieve higher resolution, higher photosensitivity, and stronger adhesion, which are advantages achieved by the present invention.

iii. The Amanokura Patent

The Amanokura Patent discloses a “photosensitive resin composition and application of its photosensitivity,” wherein the photosensitive resin composition comprises: (A) a resin having an amide bond, an oxyalkylene group and a carboxyl group, (B) a photopolymerizable compound having an ethylenically unsaturated group, and (C) a photopolymerization initiator that has alkali developability, good sensitivity and photocurability, an efficient pattern formability by photolithography, a good application workability to a film and is capable of producing cured products having good folding endurance, solder reflow heat resistance, solvent resistance, bondability and nonflammability and is suitable for producing a

photosensitive element, a photosensitive laminate and a flexible printed circuit board (See Abstract of the Amanokura Patent). More specifically, the Amanokura Patent discloses, in Synthesis Examples 4-7, a resin having an acid value of 36-77 mgKOH/g (Amanokura Patent, col. 20, line 41, to col. 22, line 52). The Amanokura Patent also discloses utilization of a bisphenol-A-type (meth)acrylate compound at col. 14, lines 14-27, and utilization of 2,4,5-triarylimidazole dimer at col. 14, line 66, to col. 15, line 11.

As admitted by the Examiner (Office Action, dated June 10, 2008, at 7, lines 6-7), the Amanokura Patent does not teach, or even suggest, component (D) recited by independent claims 1 and 20, namely, “a compound represented by the following general formula (1a), (1b), (1c), or (2)” as recited by independent claim 1, and “one or more compounds selected from the group...” recited by independent claim 20. However, this is not the only deficiency in the disclosure of the Amanokura Patent.

The Amanokura Patent also does not disclose using styrene or a styrene derivative as a copolymerizing component, or employing a binder polymer that contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters and styrene or a styrene derivative as copolymerizing components. Therefore, the Amanokura Patent does not teach, or suggest, “component (A) contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component” as recited by independent claims 1 and 20.

Furthermore, the Amanokura Patent does not teach, or suggest, adjusting the acid value of the binder polymer to “45-200 mg KOH/g” as recited by claims 1 and 20.

iv. The Grubb Patent

The Grubb Patent discloses “hexaarylbiimidazole-heterocyclic compound compositions,” which are photoactivatable compositions comprising a hexaarylbiimidazole

and a heterocyclic compound of the formula $\text{Ar}^1\text{---G---Ar}^2$ where Ar^1 is aryl of six to 12 nuclear carbons, Ar^2 is Ar^1 or arylene—G— Ar^1 and G is a divalent furan, oxazole or oxadiazole ring, and optionally, a leuco dye and/or a polymerizable monomer or inert components such as binders and solvents, wherein the compositions are photoactivated in the near ultraviolet or visible light wavelengths (See Abstract of the Grubb Patent). More specifically, the Grubb Patent discloses employing polystyrene as a binder polymer, and photopolymerizing compound with an ethylenic unsaturated bond that employs a photopolymerization initiator such as 2,4,5-triarylimidazolyl dimer, a hexaryl biimidazole, and heterocyclic compounds such as 2,5-diphenylfuran (Grubb Patent, col. 3, lines 32-33 and lines 66-69, and col. 10, line 58, and claim 1).

In Example 11, col. 14, lines 34-53, of the Grubb Patent, poly(methyl methacrylate/methacrylic acid) 90/10 is employed as binder polymer in Solution B. A person of ordinary skill in the art would know that the calculated acid value for this binder polymer is 65 mg KOH/g. However, the Grubb Patent does not specifically disclose adjusting the acid value of the binder polymer to accord with the range of 45-200 mg KOH/g as recited by independent claims 1 and 20. None of the other specific examples disclosed by the Grubb Patent include a binder polymer having an acid value in the range of 45-200 mg KOH/g.

The Grubb Patent, however, does not teach, or suggest, “a photopolymerizing compound with an ethylenic unsaturated bond...[that] contains a bisphenol A-type (meth)acrylate compound” as recited by independent claims 1 and 20. The Grubb Patent also does not teach, or suggest, “component (A) contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component” as recited by independent claims 1 and 20.

In sum, the subject matter disclosed by the Grubb Patent relates to a photopolymerization composition for planographic printing plates that has certain optical

properties, absorbance and imaging speed properties that are enhanced by combining hexaaryl biimidazole with a compound such as 2, 5-diphenyl furan. The present invention, on the other hand, suppresses contamination of a plating solution and the generation of sludge, and further improves photosensitivity, resolution and adhesion by employing the combination of components (A) to (D) as claimed. The Grubb Patent does not teach, or suggest, a composition that can suppress contamination of a plating solution, suppress sludge generation, and achieve higher resolution, higher photosensitivity, and stronger adhesion, which are advantages achieved by the present invention.

v. Summary of the Disclosures

The Ohta Patent discloses a process for preparing printed circuit board that includes forming, on the surface of an insulating substrate, a layer of a light-sensitive resin composition comprising (a) 40 to 80 parts by weight of a vinyl-polymerized high molecular weight binder having an acid value of 10 to 46 mgKOH/g, (b) 20 to 60 parts by weight of a compound having at least two polymerizable unsaturated double bonds in a molecule such as bisphenol A, with the total amount of Components (a) and (b) being 100 parts by weight, and (c) a photopolymerization initiator, such as 2,4,5-triarylimidazole dimer, generating free radicals by irradiation of active light in an amount of 0.1 to 10 parts by weight based on 100 parts by weight of Components (a) and (b). However, the Ohta Patent does not teach, or even suggest, component (D) such as “a compound represented by the following general formula (1a), (1b), (1c), or (2)” as recited by independent claim 1, and “one or more compounds selected from the group...” recited by independent claim 20.

Furthermore, while the Ohta Patent discloses that the binder has an acid value of 10 to 46 mgKOH/g, the Ohta Patent explicitly teaches away from the binder having an acid value of greater than 46 mgKOH/g and even provides comparative examples having acid values of

52 mgKOH/g and 78.2 mgKOH/g to demonstrate the deleterious effect of employing a binder having an acid value in excess of 46 mgKOH/g. Therefore, the Ohta Patent explicitly teaches away from the limitation “the acid value of component (A) is 45-200 mg KOH/g” as recited by claims 1 and 20 of the present invention.

The Amanokura Patent discloses a photosensitive resin composition that comprises: (A) a resin having an amide bond, an oxyalkylene group and a carboxyl group, (B) a photopolymerizable compound having an ethylenically unsaturated group, and (C) a photopolymerization initiator. The Amanokura Patent does not teach or suggest component (D) such as “a compound represented by the following general formula (1a), (1b), (1c), or (2)” as recited by independent claim 1, and “one or more compounds selected from the group...” recited by independent claim 20.

The Grubb Patent discloses hexaarylbiimidazole-heterocyclic compound compositions that are photoactivatable compositions comprising a hexaarylbiimidazole and a heterocyclic compound of the formula Ar^1-G-Ar^2 . However, the Grubb Patent does not teach, or suggest, “a photopolymerizing compound with an ethylenic unsaturated bond...[that] contains a bisphenol A-type (meth)acrylate compound” as recited by independent claims 1 and 20. Furthermore, while the Grubb Patent discloses a binder polymer having an acid value of 65 mg KOH/g, the Grubb Patent does not specifically disclose adjusting the acid value of the binder polymer to accord with the range of 45-200 mg KOH/g as recited by independent claims 1 and 20.

Therefore, the combination of the Ohta Patent and the Grubb Patent does not teach, or suggest, “the acid value of component (A) is 45-200 mg KOH/g” as recited by claims 1 and 20 of the present invention.

Furthermore, **neither the Ohta Patent, the Amanokura Patent nor the Grubb Patent teach, or suggest, either alone or in combination, “component (A) contains**

polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component” as recited by

independent claims 1 and 20. The combination of the Ohta Patent, the Amanokura Patent and the Grubb Patent also do not teach, or suggest, the subject matter of new claims 23-26.

For all of the above reasons, the Examiner has failed to establish a prima facie case of obviousness against claims 1, 2, 4-8, 11, 13, 15, 16, 18-20 and 23-26 of the above-captioned application.

vii. No Legitimate Reason to Combine Ohta and Grubb

A prima facie case of obviousness requires a showing that the prior art provides some teaching, suggestion or motivation, or other legitimate reason, for combining the references in the manner claimed. KSR International Co. v. Teleflex Inc., 127 S.Ct. 1727, 1739-41 (2007). In this case, the Examiner has failed to establish a legitimate reason for combining the references in the manner claimed.

The Federal Circuit has held that a modification of a prior art invention that would obliterate an essential feature thereof would not be obvious. McGinley v. Franklin Sports Inc., 60 U.S.P.Q.2d 1001, 1010 (Fed. Cir. 2001). In this case, the Ohta Patent explicitly discloses that a binder having an acid value that does not exceed 46 mg KOH/g is an essential feature of its light-sensitive resin composition in order to achieves excellent resistance to electroless copper plating and to diminish contamination of the plating solution (Ohta Patent, col. 1, line 66, to col. 2, line 13; and col. 5, lines 8-22). Therefore, modification of the subject matter disclosed by the Ohta Patent so as to employ a binder having an acid value greater than 46 mg KOH/g is not obvious as a matter of law because to do so would obliterate an essential feature of Ohta’s resin composition, thereby diminishing its resistance to electroless copper plating and causing contamination of the plating solution. Thus, the Examiner has no

legitimate reason to combine Ohta and Grubb to produce a photosensitive resin composition comprising a “binder polymer” that has an acid value of “45-200 mg KOH/g” as recited by claims 1 and 20.

Furthermore, the Ohta Patent pertains to a process for preparing a printed circuit board that achieves excellent resistance to electroless copper plating and diminishes contamination of the plating solution by keeping the acid value of the binder polymer in the range of 10 to 46 mgKOH/g, (Ohta Patent, col. 1, line 66, to col. 2, line 13; and col. 5, lines 8-22). On the other hand, the Grubb Patent pertains to hexaarylbiimidazole-heterocyclic compound compositions that achieve efficient absorption of UV radiation and improved imaging speed by combining hexaryl biimidazole and a heterocyclic compound of the formula Ar^1-G-Ar^2 . The present invention, however, pertains to a photosensitive resin composition that comprises components (A) to (D) wherein the “acid value of component (A) is 45-200 mg KOH/g” as recited by claims 1 and 20. For example, the binder polymer “A1” described in paragraph [0029] of Applicants’ disclosure, which is a mixed solution of 110 g methacrylic acid, 225 g of methyl methacrylate, 135 g of ethyl acrylate, 30 g of styrene and 3 g of azobisisobutyronitrile, has a calculated acid value of 144 mgKOH/g based on the acid value of the monopolymer of the copolymerizing component.

The photosensitive resin composition of the present invention unexpectedly achieves not only the property of a less contaminated plating solution (contrary to the teachings of the Ohta Patent), but it also achieves high photosensitivity, satisfactory minimization of sludge generation during developing, high resolution, and good adhesion characteristics. Therefore, the purpose and effect of the present invention is substantially different from that of Grubb’s hexaarylbiimidazole-heterocyclic compound compositions and of Ohta’s light-sensitive resin composition.

For all of the above reasons, a person of ordinary skill in the art would have no

legitimate reason to combine Grubb's heterocyclic compound of the formula $\text{Ar}^1\text{—G—Ar}^2$ with the subject matter of the Ohta Patent because neither of these references address the problem addressed by the present invention. For all of the above reasons, the Examiner has failed to establish a prima facie case of obviousness against claims 1, 2, 4-8, 11, 13, 15, 16, 18-20 and 23-26 of the above-captioned application.

**viii. No Reasonable Expectation of Success Combining Ohta,
Amanokura and Grubb**

A prima facie case of obviousness also requires a showing that, in addition to establishing a person of ordinary skill in the art would have had a legitimate reason to attempt to make the claimed composition or device or to carry out the claimed process, the person of ordinary skill in the art would have had a reasonable expectation of success in making the composition or device, or carrying out the process. PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007). In this case, the Examiner has failed to establish that, assuming *arguendo* there is a legitimate reason for combining the references in the manner claimed (which is an invalid assumption), there would have been a reasonable expectation of success of arriving at Applicants' claimed invention.

As discussed above, the Ohta Patent teaches away from employing a binder having an acid value greater than 46 mg KOH/g due to the deleterious effects that would occur, such as plating solution contamination and diminished resistance to electroless copper plating (Ohta Patent, col. 1, line 66, to col. 2, line 13; and col. 5, lines 8-22). In view of the above facts, a person of ordinary skill in the art would have had no reasonable expectation of success of achieving an acceptable photosensitive resin composition, much less one that has all of Applicants' claimed features including a "binder polymer" having an "acid value" of "45-200 mg KOH/g."

Furthermore, as discussed above, the combination of the Ohta Patent, the Amanokura Patent and the Grubb Patent would still fail to teach, or suggest, “component (A) contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component” as recited by independent claims 1 and 20. Therefore, a person of ordinary skill in the art would not have had a reasonable expectation of success of arriving at the claimed invention by combining the disclosures of the Ohta Patent, the Amanokura Patent, and the Grubb Patent.

For all of the above reasons, the Examiner has failed to establish a prima facie case of obviousness against claims 1, 2, 4-8, 11, 13, 15, 16, 18-20 and 23-26 of the above-captioned application.

ix. Evidence of Superior and Unexpected Results

Although the Examiner has not established a prima facie case of obviousness against the invention of claims 1 and 20 of the above-captioned application, assuming *arguendo* that such a prima facie case had been made (which is plainly an invalid assumption), Applicants have adduced evidence of substantially superior and unexpected results achieved by the present invention that is sufficient to overcome the alleged prima facie case.

The Federal Circuit has ruled that when an applicant adduces specific data demonstrating substantially improved results, and states that the results are unexpected, then in the absence of evidence to the contrary, applicant has established unexpected results sufficient to prove the invention is nonobvious. In re Soni, 34 U.S.P.Q.2d 1684, 1687-88 (Fed. Cir. 1995). Furthermore, the invention need only be compared to the closest prior art, In re Johnson, 223 U.S.P.Q. 1260, 1264 (Fed. Cir. 1984), however, it is acceptable to compare the invention to subject matter that is closer to the invention than the closest prior art. Ex parte Humber, 217 U.S.P.Q. 265, 266 (Bd. Pat. App. & Inter. 1981). In this case,

specific data pertaining to Examples 1-5 of Table 3 of Applicants' specification demonstrate substantially superior and unexpected results sufficient to overcome the Examiner's alleged prima facie case of obviousness.

Specifically, photosensitive resin compositions of Example Nos. 1 to 5, and Comparative Example Nos. 1 and 2, described on page 28, line 5, to page 30, line 13, of Applicants' specification were used to fabricate photosensitive elements and test samples as described on page 30, line 15, to page 31, line 22, of Applicant's specification as originally filed. These photosensitive elements were tested for properties relating to photosensitivity, resolution, adhesion, plating bath contamination, and generation of sludge volume as described on page 31, line 23, to page 36, line 3, of Applicants' specification as originally filed. As evident from Table 2, on page 30 of Applicants' specification, Comparative Example Nos. 1 and 2 differ substantially from Example Nos. 1 to 5 in that Comparative Example Nos. 1 and 2 do not contain component (D) in the photosensitive resin composition used to make the photosensitive elements. Thus, Comparative Example Nos. 1 and 2 are similar to the subject matter disclosed by the Ohta Patent and the Amanokura Patent, each of which disclose compositions lacking component (D).

Applicants contend that the Ohta Patent and the Amanokura Patent represent the "closest prior art" in this case. Comparative Example Nos. 1 and 2, however, represent subject matter that is closer to the claimed invention than that of the "closest prior art" because components (A) and (B) used to make Example Nos. 1 to 5 and Comparative Example Nos. 1 and 2 were identical as shown by Table 1 of Applicant's disclosure. Furthermore, component (C) used to make Example Nos. 1 and 5 was substantially similar to that of component (C) used to make Comparative Example Nos. 1 and 2 as shown by Table 2 of Applicants' disclosure. For all of the above reasons, Applicants have acceptably compared the presently claimed invention to subject matter that is closer to the invention than the

“closest prior art.” Ex parte Humber, 217 U.S.P.Q. 265, 266 (Bd. Pat. App. & Inter. 1981).

Table 3 of Applicant's disclosure tabulates the results of the comparison, and is reproduced below for the Examiner's convenience.

Table 3 of Applicant's Disclosure

	Example 1	Example 2	Example 3	Example 4	Example 5	Comp. Ex. 1	Comp. Ex. 2
Photosensitivity	9	9	9	9	9	8	9
Adhesion (μm)	35	30	30	35	30	40	45
Resolution (μm)	40	40	40	40	40	45	45
Plating bath contamination [Alloy ratio]	0.97	0.98	0.97	0.99	0.98	0.97	0.7
Sludge volume (g/L)	0.5	0.7	0.9	0.7	0.5	1.8	1.5

As evident from the data compiled in Table 3, adhesion and resolution characteristics of Example Nos. 1 to 5 (i.e., Adhesion ranging from 30-35 μm , and Resolution of 40 μm) of the present invention were substantially improved over those of Comparative Example Nos. 1 and 2 (i.e., Adhesion ranging from 40-45 μm , and Resolution of 45 μm) while photosensitivity characteristics of the present invention were maintained with respect to those of Comparative Example Nos. 1 and 2. This result is surprising in view of ¶¶ [0006]-[0010] of Applicant's disclosure because components that improve photosensitivity, such as a photopolymerization initiator, are expected to diminish adhesion and resolution characteristics. As evident from Table 3 above, this expected trade-off of properties was not observed, or was less pronounced, in Example Nos. 1 to 5 than in the Comparative Examples because the photosensitive compositions employed by Example Nos. 1 to 5 each included component (D), which Comparative Example Nos. 1 and 2 are lacking.

Furthermore, Table 3 demonstrates that Example Nos. 1 to 5 of the present invention exhibit substantial improvement in avoiding sludge generation over Comparative Example Nos. 1 and 2 (c.f., sludge volume of 0.5 to 0.9 g/L for Example Nos. 1 to 5 to a sludge volume of 1.5 to 1.8 g/L for Comparative Example Nos. 1 and 2). Thus, the present

invention exhibits a decrease in sludge generation of about 40% or more over Comparative Example Nos. 1 and 2. This substantial decrease in sludge generation exhibited by the present invention, which includes component (D), is another wholly unexpected result that could not be predicted by the prior art. Also, while Comparative Example No. 2 generated a lower sludge volume than Comparative Example No. 1, it exhibited an especially poor plating bath contamination ratio.

In sum, Applicants have demonstrated that the presently claimed invention, according to claims 1 and 20 of the above-captioned application, unexpectedly exhibits substantially improved adhesion and resolution characteristics, and unexpectedly exhibits substantially decreased sludge generation, over subject matter (i.e., Comparative Example Nos. 1 and 2) that is closer to the presently claimed invention than the subject matter disclosed by the Ohta Patent and the Amanokura Patent. Therefore, Applicants have provided the Examiner with evidence of unexpectedly and substantially superior results sufficient to overcome the Examiner's alleged prima facie case of obviousness.

III. CONCLUSION

The Examiner has failed to establish a prima facie case of obviousness against independent claims 1 and 20 because neither the Ohta Patent, the Amanokura Patent nor the Grubb Patent teach, or suggest, "component (A) contains polymerizable monomer with a carboxyl group, (meth)acrylic acid alkyl esters, and styrene or a styrene derivative as a copolymerizing component" as recited by independent claims 1 and 20. Furthermore, with respect to the combination of the Ohta Patent and the Grubb Patent, the Examiner has failed to adduce a legitimate reason to justify combination of these disclosures. The Examiner has also failed to demonstrate that a person of ordinary skill in the art would have had a reasonable expectation of success of arriving at the Applicants' claimed invention even if the

combination of Ohta, or Amanokura, with Grubb were made. In addition, Applicants have adduced evidence of substantially superior and unexpected results provided by the presently claimed invention when compared to subject matter that is closer to Applicants' claimed invention than the subject matter disclosed by the Ohta Patent and the Amanokura Patent. Therefore, even assuming the Examiner had established a prima facie case of obviousness (which is an invalid assumption), Applicants' evidence of substantially superior and unexpected results is sufficient to overcome the alleged prima facie case.

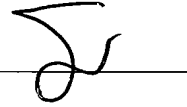
For all of the above reasons, claims 1, 2, 4-8, 11, 13, 15, 16, 18-20 and 23-26 are now in condition for allowance. Therefore, Applicants respectfully request reconsideration of the application and withdrawal of the rejections, and a prompt notice of allowance is earnestly solicited.

Questions are welcomed by the below signed attorney for the Applicants.

Respectfully submitted,

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